

DISEASES OF WESTERN WHITE PINE
OTHER THAN BLISTER RUST ^{1/}

by

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Western white pine (Pinus monitcola Dougl.) is a valuable, fast-growing coniferous species of the Pacific Northwest. It reaches its greatest productivity and abundance in the Inland Empire, particularly in northern Idaho. Although this species can be productive on many sites, and is highly prized by wood-using industries, it is beset with serious diseases. Blister rust is by far the most important disease, causing extensive losses each year. However, several other diseases including pole blight, root diseases, and needle blights and casts can also cause serious damage. Important diseases of western white pine are listed in table 1. The most important of these, with the exception of blister rust, will be discussed.

ROOT DISEASES

Besides blister rust and pole blight, root diseases are probably the most important disease problems of western white pine. The five major root pathogens on this and other conifer species are Armillaria mellea, Fomes annosus, Phaeolus schweinitzii, Phellinus weirii, and Verticicladiella spp.

Table 1.--Common diseases of western white pine.

Root Diseases

Armillaria mellea (Vahl. ex Fr.) Kummer

Fomes annosus (Fr.) Cke. (= Heterobasidion annosum (Fr.) Bref.)

Leptographium spp.

Phaeolus schweinitzii (Fr.) Pat. (= Polyporus schweinitzii Fr.)

Phellinus weirii (Murr.) Gil. (= Poria weirii (Murr.) Murr.)

Polyporus tomentosus Fr. (= Inonotus tomentosus (Fr.) Gilb.)

^{1/} Presented at the Northern Region Western White Pine Symposium, March 8-10, 1983, Coeur d'Alene, Idaho.

Poria subacida (Pk.) Sacc.

Rhizina undulata Fr.

Sparassis radicata Weir

Stereum sanguinolentum Alb. & Schn. ex Fr. (= Haematostereum sanginolentum (Alb. et. Schn. ex Fr.) Pouz.)

Verticicladiella spp.

Trunk Decays

Fomes officinalis (Bill. ex Fr.) Faull (= Fomitopsis officinalis (Vill. ex Fr.) Bund et Sing.)

Fomes pinicola (Swartz ex Fr.) Cke. (= Fomitopsis pinicola (Swartz ex Fr.) Karst.)

Fomes pini (Thore ex Fr.) Lloyd (= Phellinus pini (Thore ex Fr.) Pilat.)

Polyporus abietinus Dicks. ex Fr. (= Hirschioporus abietinus (Dicks ex Fr.) Dark)

Polyporus anceps Pk. (= Dichomitus squalens (Karst.) Reid)

Polyporus volvatus Pk. (= Cryptoporus volvatus (Pk.) Hubb.)

Stem Diseases

Arceuthobium campylopodum f. sp. blumeri (Nels.) Gill

Atropellis pinicola Zell. & Good.

Stem Diseases, cont.

Caliciopsis pinea Peck

Cenangium ferruginosum Fr.

Cronartium ribicola Fish.

Pole blight (Europhium trinacriforme Parker)

Tympanis confusa Nyl.

Foliage Diseases

Bifusella linearis (Pk.) Hoehn.

Dothistroma pini Hulb.

Lecanosticta acicola (Thum.) Syd.

Lophodermella arcuata (Dark.) Dark.

Lophodermium nitens Dark.

Seedling Diseases

Fusarium spp.

Neopeckia coulteri (Pk.) Sacc.

Pythium spp.

Thelephora terrestris Ehr.

Armillaria mellea - Armillaria is the most important root pathogen of western white pine in the Inland Empire. However, white pine is only considered moderately susceptible to the pathogen when compared with other conifer species (table 2). Armillaria appears more damaging to young stands, particularly plantations. However, older trees may also be killed.

Table 2.--Relative susceptibility of Pacific Northwest tree species to Armillaria mellea. ^{1/}

Most Susceptible

True firs (Abies spp.)
Douglas-fir (Pseudotsuga menziesii)
Western hemlock (Tsuga heterophylla)

Moderately Susceptible

Spruce (Picea spp.)
Western redcedar (Thuja plicata)
Lodgepole pine (Pinus contorta)
Western white pine (Pinus monticola)
Hardwood species

Least Susceptible

Ponderosa pine (Pinus ponderosa)
Western larch (Larix occidentalis)

^{1/} Derived by D. J. Morrison for the southern interior forests of British Columbia (see Morrison, D. J. 1981. Armillaria root disease. A guide to disease diagnosis, development and management in British Columbia. Can. For. Ser., Pac. For. Res. Cen., Rept. BC-X-203, 15 pp.

Much of the research involving Armillaria root disease has been done in British Columbia. These studies have indicated that the pathogen acts differently in the wet coastal forests than in the drier interior forests. For example, in coastal forests Armillaria begins causing mortality of young trees when they are about 5 years old. Mortality reaches its maximum when trees are 10-15 years old; mortality is rare after trees reach 25 years of age. In these forests, small groups of mortality (5-6 trees) often occur. Disease centers usually do not enlarge because trees become resistant to the fungus with age. In coastal forests, generally all conifer species up to 10-15 years of age show the same level of susceptibility to Armillaria. On the other hand, within interior forests, mortality begins when trees are 5-10 years old and continues throughout the rotation, often resulting in large unstocked or understocked openings. Differences in species susceptibility (table 2) becomes most apparent on trees over 40 years old.

Western white pine can best resist root diseases on good sites. In mixtures with other common species, mortality is usually greater on Douglas-fir, grand fir, and western hemlock than on western white pine. However, there may be Armillaria strains that are more pathogenic to pine than these other species. Research is planned to help identify possible differences in pathogenicity among populations of Armillaria.

The following guidelines can be used to help reduce losses from Armillaria and other root diseases in forests of the Inland Empire: 2/

1. If there are 10 or more root disease centers per hectare, precommercial thinning is not recommended because it will likely result in serious understocking.
2. If fewer disease centers exist, normal thinning can be done, except around the disease centers. Around these centers, trees should not be spaced or the least susceptible species should be left.
3. If a stand is heavily infected, commercial thinning should be excluded. Consideration should be given to harvesting the stand if net volume increment (growth minus mortality) is unacceptable.
4. If a stand is lightly infected, it may be commercially thinned. However, disease centers should receive special treatments, depending on the frequency of harvest or salvage operations in the stand. When stands can be entered at 5- to 10-year intervals, all dead trees and those with crown symptoms should be salvaged. If the interval between stand entries is greater than 10 years, all dead and symptomatic trees and those within 10 meters of symptomatic trees should be removed.

2/ Management guidelines derived from: Morrison, D. L. 1981. Armillaria root disease. A guide to disease diagnosis, development and management in British Columbia. Can. For. Serv., Pac. For. Res. Cen., Rept. BC-X-203, 15 pp.

5. In stands infected with root diseases, partial or diameter limit cutting is not recommended.

6. When harvesting infected stands, root pathogen inoculum can be eliminated from disease centers by removing all stumps and large roots from the ground with a bulldozer fitted with a brush blade. The site may then be regenerated to any desired species.

7. If inoculum cannot be removed due to economic or terrain limitations, the least susceptible species should be favored. Clear-cutting followed by planting is often required.

Fomes annosus - Importance of this fungus on western white pine is largely unknown. Fomes annosus was the second most common root pathogen on western white pine in a survey several years ago. The fungus was found mostly on older mature trees. Fomes annosus may be associated with Armillaria infection and bark beetle attacks. The fungus is very common within plantations of eastern white pine in the eastern United States.

Phaeolus schweinitzii - This fungus is found primarily on mature trees causing root and butt decay. A survey conducted on the St. Joe portion of the Idaho Panhandle National Forest indicated that the fungus was common on overmature western white pine, but little mortality was found. Phaeolus schweinitzii may predispose trees to windthrow and attack by other root fungi and bark beetles (particularly the western pine beetle). Importance of this fungus on young trees and regeneration is unknown.

Phellinus weirii - Western white pine is generally considered tolerant of this fungus (table 3). Although this species may be infected when it is growing in association with more susceptible species, it is rarely killed. Some limited butt rot may occur. Western white pine is probably a good alternative species for regenerating the large disease centers caused by P. weirii in northern Idaho and northwestern Montana. However, when regenerating these sites, care should be taken to avoid dense, stagnated stands which may lead to the pole blight syndrome.

Table 3.--Relative susceptibility of Pacific Northwest tree species to Phellinus weirii. ^{1/}

Susceptible

Grand fir (Abies grandis)
Douglas-fir (Pseudotsuga menziesii)
Mountain hemlock (Tsuga mertensiana)

Intermediately Susceptible

Subalpine fir (Abies lasiocarpa)
Western larch (Larix occidentalis)
Engelmann spruce (Picea engelmanni)
Western hemlock (Tsuga heterophylla)

Table 3.--continued

Tolerant

Lodgepole pine (Pinus contorta)
 Western white pine (Pinus monticola)

Resistant

Ponderosa pine (Pinus ponderosa)
 Western red cedar (Thuja plicata)

Immune

Hardwood species

1/ Derived from: Hadfield, J. S. and D. W. Johnson. 1976.
 Laminated root rot. A guide for reducing and preventing losses in
 Oregon and Washington forests. USDA For. Ser., Pacific Northwest Region
 Report. 16 pp.

Verticicladiella and Leptographium spp. - These fungi cause black staining
 of roots which may lead to wild symptoms and mortality of infected
 trees. Bark beetles usually attack trees weakened by black stain fungi.
Verticicladiella has been found on western white pine in California and
 is common within eastern white pine plantations in Montana and the
 eastern United States. Occurrence of Verticicladiella on western white
 pine in northern Idaho or northwestern Montana has not yet been verified.
Leptographium, a fungus very similar to Verticicladiella, has often been
 located within the roots of pole-blighted trees. Pathogenicity of this
 fungus is unknown.

TRUNK DECAYS

These diseases are usually problems only in mature or overmature trees
 greater than 120 years old. Although many different decay fungi occur
 on western white pine, Fomes pini is probably the most damaging. This
 fungus causes white pocket rot of the heartwood of living trees. Damage
 is more common on cool, wet sites. Indications of decay are sporophores
 or punky knots on the bole of infected trees.

STEM DISEASES (excluding blister rust)

Dwarf mistletoes are usually not important on western white pine. The
 parasite may locally cross over from infected western larch, but pine is
 not a congenial host and little damage occurs. Atropellis is a nonrust
 canker-causing fungus that may be an aggressive pathogen, particularly
 on stressed trees. Other canker fungi usually only cause limited
 damage.

Pole blight is a common disease on western white pine trees from 40-100 years old. The disease causes short chlorotic foliage, long, flat bole cankers, and eventual mortality. A fungus (Euophium trinacriforme) usually colonizes cankered tissues and may aid in girdling the stem of diseased trees. Pole blight results from small rootlet deterioration of trees growing on shallow soils with poor moisture holding capacity. Roots are unable to meet the tree's water requirements resulting in extreme stress. Western white pine is unable to compete for limited soil moisture as well as other conifer species. Climatic changes with a trend toward lower annual precipitation and higher temperatures in regions where the disease is common may be involved.

FOLIAGE DISEASES

There are several diseases of western white pine which may cause extensive foliage discoloration and defoliation. The most damaging foliage pathogen is Lecanosticta acicola. This fungus causes spotting, blighting, and shedding of foliage in the lower crown. All foliage greater than 1 year old may be affected. Other notable foliage pathogens include Lophodermella arcuata, Dothistroma pini, and Lophodermium nitens. Most of these only cause local damage, although L. arcuata may cause upper crown defoliation over large areas.

SEEDLING DISEASES

Germination of western white pine seed for nursery production of seedlings is often difficult. Seedlings may be subjected to common nursery diseases such as damping-off and root diseases caused by Fusarium spp. and Pythium spp. Soil fumigation of nursery beds usually precludes damage by these pathogens.